COURSE OUTLINE

1. COURSE INFORMATION

SCHOOL	School of Chemical and Environmental Engineering		
DEPARTMENT			
COURSE LEVEL	Postgraduate		
COURSE ID	**A104**	**SEMESTER**	Spring
COURSE TITLE	Advanced Oxidation Processes for Water and Wastewater Treatment		

COURSE MODULES *in the case of credits being awarded in distinct parts of the course eg. Lectures, Laboratory Exercises, etc. If credit units are awarded uniformly for the whole course, indicate the weekly hours of teaching and the total number of credits.*	**INSTRUCTION HOURS PER WEEK**	**CREDITS**
Lectures	3	
Laboratories		
Tutorial Exercises		
Total	3	9
Add rows if needed. The teaching organization and teaching methods used are described in detail in (4).		

COURSE TYPE *Background, General Knowledge, Scientific Area, Skills Development*	General Background
PREREQUISITES:	-
INSTRUCTION/EXAM LANGUAGE:	English
THE COURSE IS OFFERED TO ERASMUS STUDENTS:	Yes
COURSE URL:	EURECA PRO LMS Moodle URL: https://moodle.eurecapro.tuc.gr/course/view.php?id=79

2. LEARNING OUTCOMES

Learning Outcomes

The learning outcomes of the course describe the specific knowledge, skills and competences of an appropriate level that students will acquire after successfully completing the course.

Refer to Appendix A.

- *Description of the Level of Learning Outcomes for each course of study in line with the European Higher Education Area Qualifications Framework*
- *Descriptive Indicators of Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Annex B*
- *Learning Outcomes Writing Guide*

After completing this course the student will be able to:

- Analyze experimental results published in the literature regarding the application of advanced oxidation processes for water and wastewater treatment
- Choose the most efficient method(s) for water and wastewater treatment
- Collect data published in the scientific literature concerning water pollution and advanced oxidation processes for water and wastewater treatment
- Compare the efficiency of the various advanced oxidation processes for the degradation of organic pollutants in aqueous matrices
- Comprehend the fundamental target of advanced oxidation processes for water and wastewater treatment
- Describe the general methods used for water and wastewater treatment
- Evaluate the various advanced oxidation processes in terms of their reactivity towards the

degradation of organic pollutants in the aqueous phase
- Explain the basic mechanism of the various advanced oxidation processes
- Propose appropriate advanced oxidation processes for the degradation of various classes of organic pollutants
- Recognize the main advantages and disadvantages of the advanced oxidation processes
- Relate the structure of various organic pollutants with their reactivity towards advanced oxidation processes
- Review the basic principles of advanced oxidation processes
- Select the most efficient advanced oxidation processes in terms of their energy consumption and cost
- Use the knowledge gained in the course regarding advanced oxidation processes for large scale applications
- Design a treatment train for water and wastewater

General Competencies/Skills

Considering the general competencies that the graduate must have acquired (as listed in the Diploma Supplement and below), which one(s) the course enhances?

Search, analysis and synthesis of data and information, using the necessary technologies
Adaptation to new situations
Decision making
Autonomous work
Teamwork
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project design and management
Respect for diversity and multiculturalism
Respect for the natural environment
Demonstration of social, professional and moral responsibility and sensitivity to gender issues
Exercise criticism and self-criticism
Promoting free, creative and inductive thinking

- Search, analysis and synthesis of data and information, using the necessary technologies
- Adaptation to new situations
- Decision-making
- Autonomous work
- Teamwork
- Working in an international environment
- Working in an interdisciplinary environment
- Respect for the natural environment
- Promoting free, creative and inductive thinking
- Written communication
- Oral communication
- Alternative/Innovative Thinking
- Problem Solving

3. COURSE SYLLABUS

1. Water pollution
2. Water and wastewater treatment
3. Overview of Advanced Oxidation Processes (AOPs)
4. Redox reactions and electrochemical processes
5. UV photolysis, Part I
6. UV photolysis, Part II
7. UV/H_2O_2 processes
8. Ozone in water and wastewater treatment, Part I
9. Ozone in water and wastewater treatment, Part II
10. Ozone in water and wastewater treatment, Part III
11. Fenton-based processes, Part I
12. Fenton-based processes, Part II
13. Fenton-based processes, Part III

4. TEACHING and LEARNING METHODS – ASSESSMENT

LECTURE METHOD *Face to face, distance learning, etc.*	Direct (face to face) and distance learning
USE OF INFORMATION AND COMMUNICATION TECHNOLOGY *Use of ICT in Teaching, in Laboratory Exercises, in Communication with students*	• Power point presentations • E-class support
TEACHING ORGANISATION *Describe in detail the way and methods of teaching.* *Lectures, Seminars, Laboratory Exercise, Field Exercise, Literature review & analysis, Tutoring, Practice (Placement), Clinical Exercise, Artistic Lab, Interactive teaching, Educational visits, Project work, project, etc.* *The student's study hours for each learning activity and the hours of non-guided study according to the ECTS principles are mentioned.*	

ACTIVITY	***Workload per semester (in Hours)***
Lectures	39
Tutorials	
Lab assignments	
Projects	100
Autonomous study	86
Course Total (25 hours' workload/ECTS credit)	***225***

ASSESSMENT METHODS *Description of the evaluation process* *Assessment Language, Assessment Methods, Formative or Concluding, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Essay / Report, Oral Exam, Public Presentation, Laboratory Assignment, Clinical Examination of Patients, Artistic Interpretation, Other well defined student assessment criteria are mentioned. Mention whether and how the students can access them.*	Assessment Language: English Assessment Method: Individual project including public presentation and oral examination. Summative assessment: students will receive a grade (score) indicating their overall performance during project preparation, presentation and oral examination.

5. DIGITIZATION (use of tools & software)

Eclass, Moodle, Zoom

6. RECOMMENDED INTERNATIONAL LITERATURE

- Advanced Oxidation Processes for Water Treatment, Edited by: Mihaela Stefan, IWA Publishing, 2017, ISBN: 9781780407180. https://doi.org/10.2166/9781780407197
- Advanced Oxidation Processes for Water and Wastewater Treatment, Edited by: Simon Parsons, IWA Publishing, 2004, ISBN: 9781843390176. https://doi.org/10.2166/9781780403076
- Advanced Oxidation Processes for Wastewater Treatment, Edited by: Suresh Ameta, Rakshit Ameta, Academic Press, 2018, ISBN: 9780128104996. https://doi.org/10.1016/C2016-0-00384-4
- Chemistry of Ozone in Water and Wastewater Treatment, by Clemens von Sonntag, Urs von Gunten, IWA Publishing, 2012, ISBN: 9781843393139. https://doi.org/10.2166/9781780400839
- Water Treatment, Principles and Design, by Crittenden, Trussell, Hand, Howe, Tchobanoglous, John Wiley & Sons, 3rd Edition, 2012, ISBN: 9780470405390. https://doi.org/10.1002/9781118131473
- Wastewater Engineering: Treatment and Resource Recovery, by Tchobanoglous, Stensel, Tsuchihashi, Burton, McGraw Hill, 5th Edition, 2013, ISBN: 9780073401188.

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